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(54) **Keyboard**

(67) A keyboard has keys for L-shaped 22', T-shaped 24' and cruciform intersections 26' for graphic representations of frames and boxes. The disposition of each key in the array of keys corresponds to the normal disposition of the intersection associated with such key in the frames or boxes. The numerals or graphics can be accessed by a shift key 32.

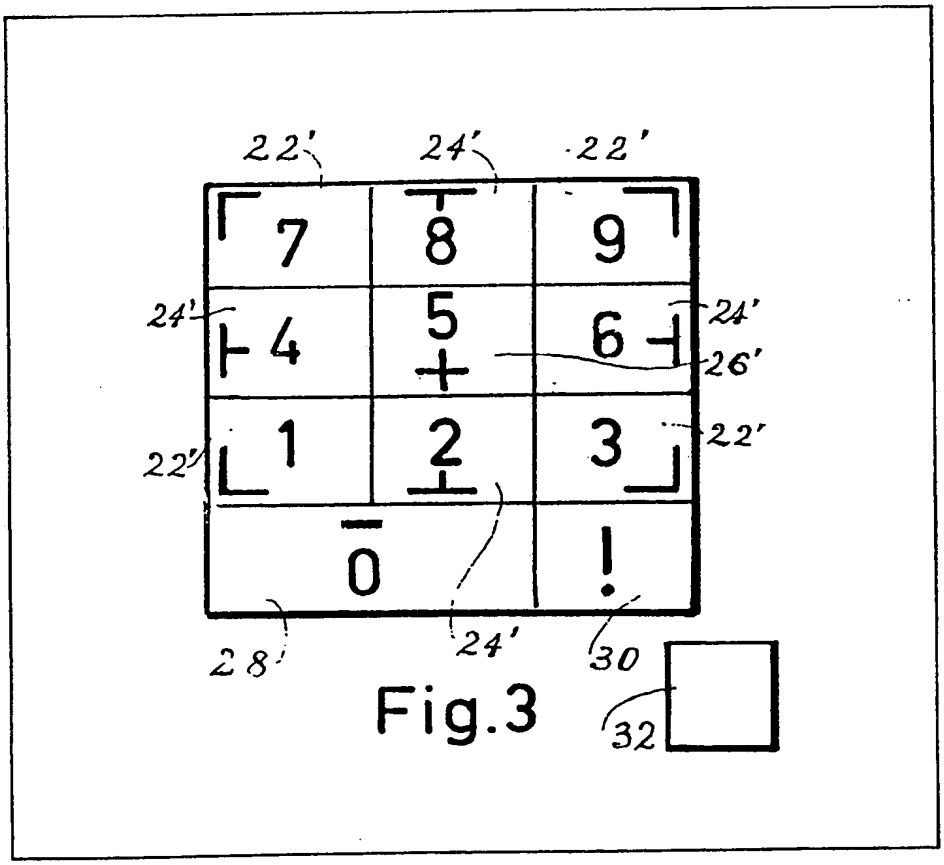

Fig.3

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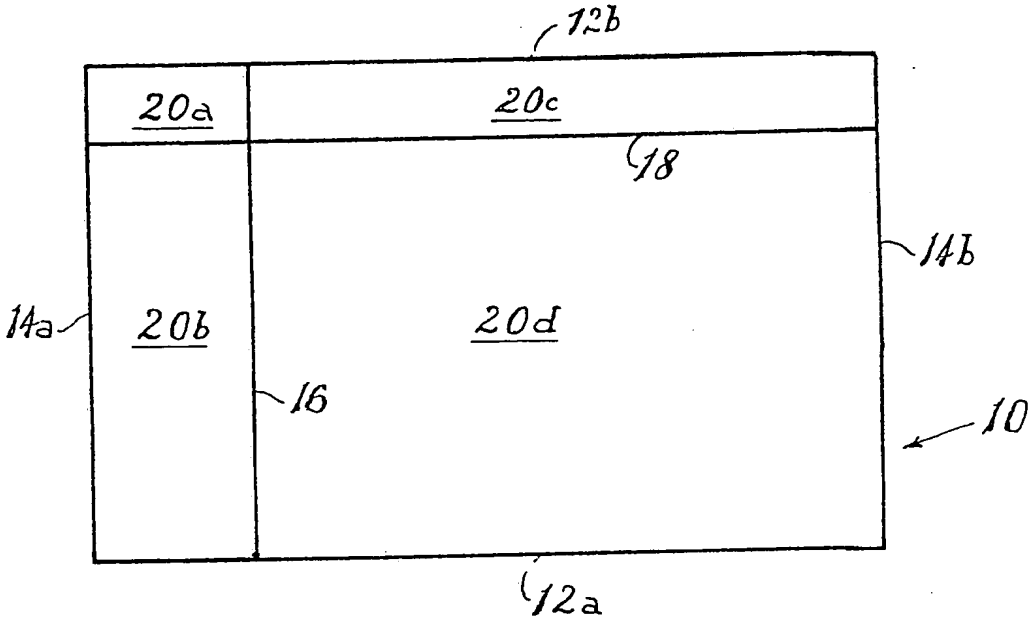
Fig.1



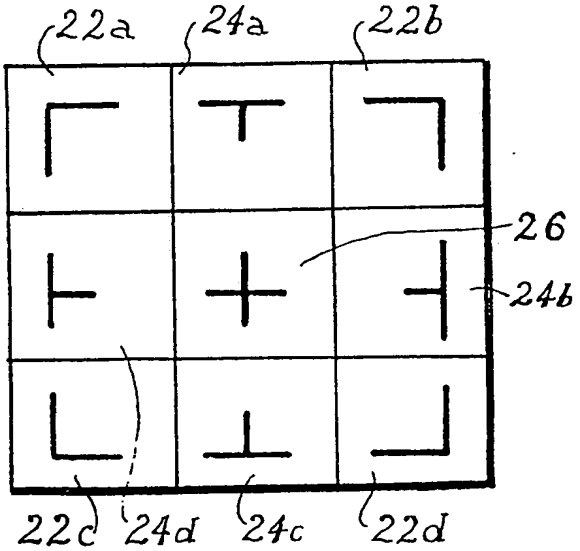


Fig.2

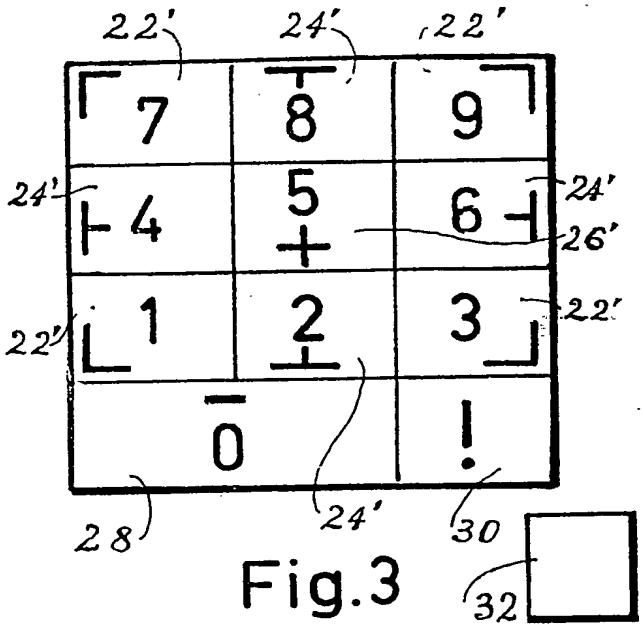


Fig.3

SPECIFICATION

Keyboard

Background of the invention

This invention relates to a keyboard of the type utilized for entering graphic information into an information processing device.

There are numerous types of information processing devices presently in use, ranging from mechanical typewriters to electronic digital computers. These devices are often equipped with keyboards for entering alphanumeric information. Such information may be output or displayed by the device simultaneously with its entry from the keyboard as in an ordinary typewriter. Alternatively, the information may be stored in the device after its entry from the keyboard and output or displayed at some later time.

Many modern information processing devices are capable of handling graphic information in addition to alphanumeric information. For example, certain devices are capable of handling information representative of boxes or frames composed of horizontal and vertical lines. Such boxes or frames may be displayed along with the alphanumeric information. This capability is especially useful in presenting accounting and statistical data in tabular form. The vertical lines of the boxes may indicate the borders of the table or the boundaries between adjacent columns within the table. The horizontal lines may also define borders of the table and may separate various portions of the columns of data for easier reading.

Keyboards have been developed for entering the aforementioned graphic information into information processing devices. Such keyboards generally include a horizontal line key and a vertical line key. The operator can "draw" an image of a horizontal line by depressing the horizontal line key. Information representative of a vertical line is entered in a similar manner with the vertical line key. It is difficult to create boxes and frames having a neat appearance using only the horizontal and vertical line keys because it is difficult to create proper representations of certain types of line intersections by the use of such keys. For xample, the creation of a neat, L-shaped corner requires the operator to control both the horizontal and vertical line keys so that the intersecting horizontal and vertical lines both terminate exactly at the point of intersection.

To avoid these difficulties, keyboards for entering graphic information have been provided with other keys for entering signals representative of the desired intersections. Thus, special keys have been provided for L-shaped, T-shaped and cruciform intersections. By depressing the appropriate key, the operator can signal the device that a particular intersection is desired and the device will automatically generate a perfect intersection. To operate such a keyboard efficiently, the operator must learn the arrangement of the intersection keys on the keyboard and recall such arrangement during operation of the keyboard. However, the graphic keyboards available heretofore have generally been ill-suited to such learning and recall as the intersection keys have generally been disposed on such keyboards in an illogical fashion.

Summary of the invention

The present invention provides a graphic keyboard which is easy to use because the keys for the various intersections are disposed on the keyboard in positions corresponding to the most common positions of the intersections associated with such keys in the boxes or frames to be produced. For example, an L-shaped intersection composed of a vertical line extending upwardly from the point of intersection and a horizontal line segment extending to the right from the point of intersection is generally placed at the extreme lower left corner of a box or frame. In a keyboard according to the present invention, the key for this intersection is disposed at the lower left corner of an array of intersection keys.

As used in this disclosure, the term "L-intersection" refers to an L-shaped intersection between a vertical line and a horizontal line. The terms upper, lower, left-hand and right-hand are used to describe the orientation of L-intersections. In an upper corner, the vertical line extends downwardly from the point of intersection; in a lower corner, the vertical line extends upwardly from such point. In a left-hand corner, the horizontal line extends to the right from the point of intersection and in a right-hand corner, the horizontal line extends to the left from such point.

The term "T-intersection" refers to a T-shaped intersection between vertical and horizontal lines in which one of such lines extends in both directions from the point of intersection, thus forming the cross bar of the T, and the other one of such lines extends in only one direction from the point of intersection, thus forming the stem of the T. The terms left, right, top and bottom are utilized to describe the orientation of T-intersections. In a left T-intersection, the cross bar of the T is disposed at the left and the st m extends to the right from the point of intersection. In a right T-intersection, th stem extends to the left from such point. In a top T-intersection, the cross bar is at the top and the stem extends downwardly from the point of intersection. In a bottom T-intersection, the cross bar is at the bottom and th stem extends upwardly from the point of intersection.

In a keyboard according to the present invention, one key is provided for each of the af rementioned L- and T-intersections. Such keys are disposed in an array, the keys for the upper left, lower left, upper right and lower right L-intersecti ns being disposed, respectively, at the upper left, lower left, upper right and lower right corners of the array. The keys for the T-intersections are disposed along the edges of the array between the keys for the L-intersections. The keys for the bottom, top, left and right T-intersections are disposed,

respectively, at the bottom, top, left and right edges of the array. A key for a cruciform intersection may be provided, such key being disposed adjacent the center of the array.

The array may be in the form of a matrix, having three columns and three rows. Additional keys for horizontal lines and vertical lines may also be provided, and such additional keys may be disposed adjacent the bottom edge of the array.

The keys for the intersections and lines may also serve as keys for entering numerical information, shift means being provided for selecting between a first mode in which the keys are used to enter graphic information and a second mode in which the keys are used to enter numerical information. This embodiment is especially useful because numerical information is often entered in conjunction with graphic information for boxes and frames, as in preparing tables of accounting or statistical data. Morever, the arrangement used in one embodiment of the present invention for the intersection, horizontal line and vertical line keys is identical with the arrangement of keys commonly used for entering numerical information into information processing apparatus. Accordingly, the operator need not learn a whole new arrangement of keys for entering numerical data.

These and other objects, features and advantages will be more readily apparent from the following detailed description of the preferred embodiments taken in conjunction with the accompanying drawings.

Brief description of the drawings

Figure 1 depicts a typical frame of the type which may be produced by the use of a keyboard according to the present invention.

Figure 2 is a plan view depicting a keyboard according to a first embodiment of the present invention.

Figure 3 is a view similar to Figure 2 but depicting a keyboard according to a second embodiment of the present invention.

Detailed description of the preferred embodiments

As shown in Figure 1, a typical frame includes horizontal border lines 12a and 12b and vertical border lines 14a and 14b. Interior vertical line 16 and interior horizontal line 18 subdivide the space within the frame into four discrete areas 20a through 20d. Such a frame may be utilized in conjunction with numerical data, different portions of such data being displayed within each area 20a through 20d.

There are L-intersections between the border lines at the four corners of the frame. For example, there is a lower left-hand L-intersection between border lines 12a and 14a at the bottom left corner of the frame, and there is an upper right corner intersection between lines 12b and 14b at the upper right corner of the frame. There is a cruciform intersection between interior lines 16 and 18 adjacent the center of the frame and there are T-intersections along the edges of the frame. For example, there is a bottom T-intersection between lines 12a and 16 and there is a right T-intersection between lines 14b and 18.

The keyboard illustrated in Figure 2 has keys for the intersections used in the frame described above. As illustrated, each key has marked upon it indicia representative of the intersection associated with such key. Keys 22a through 22d are associated with L-intersections, keys 24a through 24d are associated with T-intersections, and key 26 is associated with the cruciform intersection. For example, when key 24a is depressed, a signal representative of a top T-intersection is entered into the information processing device; when key 22d is depressed, a signal representative of a lower right-hand L-intersection is entered.

The keys are disposed in an array in the form of a three column by three row matrix. The dispositions of the various intersection keys correspond to the most common dispositions of the associated intersections in frames such as that illustrated in Figure 1. Thus, the L-intersection keys are disposed at the corners of the array, the T-intersection keys along the edges of the array between the L-intersection keys and the cruciform intersection key is disposed in the center of the array. This logical relationship between the placement of each key in the array and the normal placement of the intersection symbol associated with such key in the frames to be generated makes it easy for the operator to learn the positions of the various keys and makes it easy for the operator to strike the right key during operation.

The keyboard illustrated in Figure 2 may also be provided with additional keys (not shown) for entering signals representative of horizontal and vertical lines into the information processing device. Of course, other keys for entering alphabetic and numerical information and for other purposes may also be provided. The keyboard will have an internal mechanism selected in accordance with the type of information processing device. If the information processing device is a mechanical typewriter, the keyboard would ordinarily have a mechanical internal mechanism arranged so that depression of each key enters a signal into the mechanism of the device by moving some mechanical element. By contrast, if the information processing device is electronic, the internal mechanism of the keyboard would incorporate appropriate transducers for producing electrical signals upon depression of the keys.

The keyboard illustrated in Figure 3 has a 3 × 3 array of keys 22' through 26' similar to the keys of the keyboard of Figure 2. The keyboard of Figure 3, however, has two additional keys 28 and 30 disposed adjacent the bottom edge of the array and a shift key 32. Each of the keys 22' through 26' has associated with it a numerical digit from 1 through 9 inclusive as well as an intersection. In a first mode, selected by depressing the shift key, depression of any one of the keys 22' through 26' will cause entry of a signal representative of the intersection associated with such key. In the second mode, selected by releasing the shift key, depression of any one of the keys 22' through 26' will produce entry of a signal representative of

the digit associated with such key. For example, when the keyboard is in the first mode and key 26' is depressed, a signal representative of a cruciform intersection will be entered. If this same key is depressed when the device is in the second mode, a signal representative of the digit 5 will be entered. The operation of additional keys 28 and 30 also varies with the mode of operation. Depression of additional key 28 in the first mode will enter a signal representative of a horizontal line, but depression of this key in the second mode will enter a signal representative of the digit zero. Additional key 30 is operative in the first mode to enter a signal representative of a vertical line and in the second mode to enter a signal representative of a decimal point.

The keyboard illustrated in Figure 3 provides a logical arrangement of the intersection, vertical line and horizontal line keys. These same keys are disposed in an arrangement corresponding to the arrangement of numerical digit keys on many present keyboards. Accordingly, this keyboard provides ease of operation both in the graphic mode and in the digit mode. Because the same keys are utilized for entering the graphic information and numerical information, the operator need not shift his hand when composing a table having columns of figures enclosed in a frame. The digits associated with the various keys can be altered, if desired, to correspond with other standard numerical key arrangements. For example, to provide an arrangement of digits similar to that found in standard push-button telephones, the digits 1, 2 and 3 could be associated with the top row of keys 22', 24' and 22' and the digits 7, 8 and 9 could be associated with the bottom row of such keys.

A keyboard according to the present invention has been successfully utilized in conjunction with an information processing device of the type sold under the designation 2645A Display Station by Hewlett-Packard Co. of Palo Alto, California. In this application, the keyboard according to the present invention replaces the group of numeric keys ordinarily provided in a keyboard supplied with the device

As will be appreciated, numerous variations and combinations of the features described above can be utilized without departing from the present invention as described in the claims. Merely by way of example, the keys need not be square or rectangular as depicted in the drawings; keys of any shape may be utilized. Also, it is not essential to provide indicia on the keys illustrating the intersections and digits associated therewith. Accordingly, the foregoing description of the preferred embodiments should be understood by way of illustration rather than by way of limitation of the present invention.

CLAIMS

1. A keyboard for introducing into an information processing device signals representative of upper and lower left-hand L-intersections, upper and lower right-hand L-intersections, left, right, top and bottom T-intersections, and a cruciform intersection, said keyboard comprising:

one key for each of said intersections, said keys being disposed in an array, the keys for the upper left, lower left, upper right and lower right L-intersections being disposed, respectively, at the upper left, lower left, upper right and lower right corners of the array, the keys for the T-intersections being disposed along the edges of the array between the keys for the L-intersections, the keys for the bottom, top, left and right T-intersections being disposed, respectively, at the bottom, top, left and right of the array, the key for the cruciform intersection being disposed adjacent the center of the array.

2. A keyboard as claimed in claim 1 in which said array is in the form of three vertical columns and three horizontal rows.

3. A keyboard as claimed in claim 1 further comprising shift means for selecting either a first mode of operation or a second mode of operation, said keys being operative in said first mode to enter signals representative of said intersections, said keys being operative in second mode to enter signals representative of numerical digits, there being a different digit associated with each of said keys.

4. A keyboard as claimed in claim 3 in which the digits and intersections associated with said keys are as follows:

DIGIT	INTERSECTION
1	lower left L
2	bottom T
3	lower right L
4	left T
5	cruciform
6	right T
7	upper left L
8	top T
9	upper right L

5. A keyboard as claimed in claim 4 further comprising an additional key for entering, in said first mode, a signal representative of a horizontal line and an additional key for entering, in said first mode, a signal representative of a vertical line, one of said additional keys being operative in said second mode to enter a signal representative of the digit zero, the other one of said additional keys being operative in said second mode to enter a signal representative of a decimal point.

6. A keyboard as claimed in claim 5 in which the additional key associated with the horizontal line is the key associated with the digit zero.

7. A keyboard as claimed in claim 5 in which said additional keys are disposed adjacent the bottom edge of said array.

8. A keyboard as claimed in claim 1 further comprising an additional key for entering a signal representative of a horizontal line and an additional key for entering a signal representative of a vertical line.

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